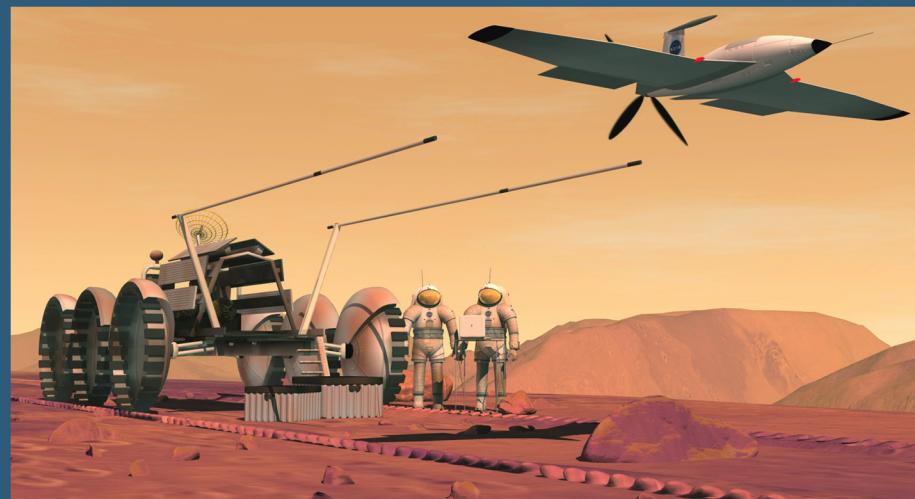




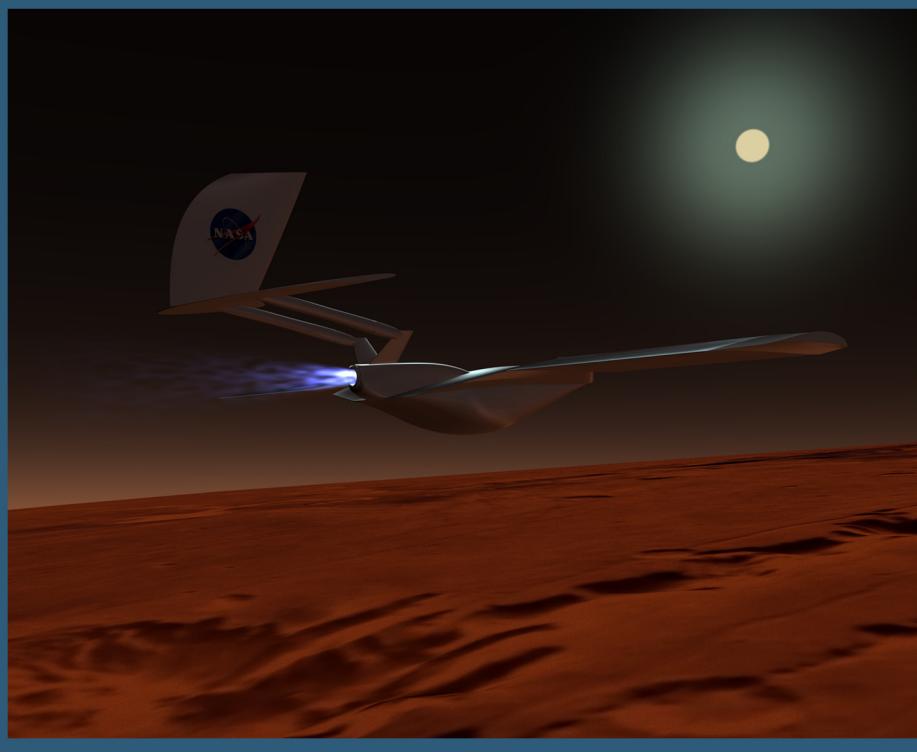
NASA Aeronautics University Level Student Competition

2004-2005 Academic Year



The Aeronautics Research Mission Directorate and Langley Research Center's Aeronautics Directorate announce a new student competition for the 2004-2005 academic year.

[http://avst.larc.nasa.gov/
competitions_univ.html](http://avst.larc.nasa.gov/competitions_univ.html)



National Aeronautics and
Space Administration
<http://www.nasa.gov>

*Pictures to the left are
artist conceptions of Mars missions.*

Overview

This year there will be only one category of vehicle for students to discuss, the Exploration Air Vehicle or EAV. The EAV is a class of autonomous, unmanned aircraft that can perform diverse types of missions on Earth or on other planets. Entries will characterize the technologies and systems required for the successful operation of EAVs regardless of environment where deployed. Students may define any mission they choose in order to characterize their vehicle and its systems. All missions must be defined using: flight time to station, time on station, flight time back to home base, time between missions, altitude maximums, propulsion and fuel type, weather conditions, terrain, weight of vehicle and payload, and others that students might want to include.

The following scenario can be used as an example of a possible mission.

Terrestrial EAVs

Consider the scenario of an EAV on Earth that functions as a sentinel for wildfire management. This EAV would have direct communication links with an Earth Observing Satellite system and with the wildfire management system. If a satellite detected an atmospheric disturbance, such as a lightning strike, it would quickly communicate the pertinent geographic information to the sentinel. Within ten minutes of receiving the communication from the satellite, the EAV would power up, take off and fly to the lightning strike location. Flight time would be no more than twenty minutes. While on station, the EAV would relay the situation specifics to the appropriate human resources. After relaying the initial information, the sentinel could wait on station for up to thirty minutes to accept additional imaging instructions from the humans monitoring the situation. The EAV could stay in the air for up to three hours if needed. After the need for the sentinel had passed, it could fly back to its home base to await further action.

During all of the flight time, the EAV could safely operate in our national airspace system and be compatible with Homeland Security and FAA regulations.

In the scenario just described, what types of technologies would be required for the smooth operation of the EAV?

- Secure, wireless communications, unimpeded by weather conditions
- Autonomous power up, take off* and flight to the location under investigation and autonomous flight and landing* back to home base (*STOL, ESTOL, VTOL)
- High level of maneuverability with terrain sensitive take off and landing capability
- Surveillance equipment capable of multi spectral and fine resolution imaging, regardless of weather conditions
- Constant source of renewable power for propulsion and systems operations
- Strong, lightweight, streamlined construction designed to withstand large temperature extremes
- Minimal maintenance, highly reliable components
- Homeland security clearance technology, impervious to sabotage

What would these systems weigh and how would that impact the design of the vehicle? How much would it cost in today's market to build these systems and the vehicle?

All student entries must contain a realistic cost analysis and a base-line comparison with known technologies and vehicles.

Extra-Terrestrial EAVs

For an EAV to be useful on Mars, it would have to have technologies similar to that of Earth-based EAV. Notable exceptions would be:

- The absence of global-positioning system technology and surface infrastructure
- All structures and systems capable of operating in high radiation environment within known Martian temperature extremes
- All systems survive launch and entry to Martian atmosphere (vibration and G-forces)
- All systems survive the flight time to Mars in stowed configuration

- Small volume and weight in stowed configuration
- Deployment concepts either during or after landing
- Heat dissipation in Martian atmosphere
- Data transmission to Mother Ship or Earth
- Conduct autonomous missions in highly uncertain conditions
- Perform as integrated team member with surface robots and/or human explorers
- Significant onboard data processing to minimize bandwidth required for data transmission

How would the systems be tested here on Earth to insure they would withstand the Martian environment? All student entries must contain a valid testing scenario, a realistic cost analysis, and a base-line comparison with known technologies, robotic surface missions, and launch costs using today's known launch constraints.

Aerodynamic Considerations

The aerodynamics of the various EAVs will be determined by their missions, either on Earth or on Mars. Aerodynamics are not the focus of this competition, but should be addressed with sufficient information to back up student designs.

What is required to enter?

The challenge to students seeking to design an EAV is to characterize the technologies necessary for the mission they propose, whether it is on Earth or elsewhere in the solar system. If students choose to send an EAV to explore outside of Earth's atmosphere, they will need to provide a realistic but brief description of how the EAV will be transported to the other planet and how the EAV will be deployed from the mother ship.

In twenty-five pages or less, the students must describe a plausible mission, adequately characterize the complete EAV including necessary onboard technologies, and if they choose an Earth mission, they must address the safe deployment of the EAV in conventional national air space appropriate for the mission they choose.

Any proposed future technologies must be well defined and be accompanied by a base-line com-

parison with current technologies. All entries must be grounded in a current literature search and that search must be well documented. All entries must provide a realistic cost analysis for the mission and the EAV.

If students wish to be considered for a possible follow-on build and test phase, they may submit a three page proposal to build and test their EAV. These proposals should be not be included in the main body of the entry, but may be included in an appendix.

See the appropriate sections on the website for eligibility, due dates, submission requirements, format, evaluation criteria, required ancillary material, contacts for questions, etc. (http://avst.larc.nasa.gov/competitions_univ.html)

Dates

Fall Semester 2004 - Spring Semester 2005

- 01/01/05 - Submission of Letters of Intent (required)
- Letters of Intent are required and must include a statement saying the team is not participating in a related NASA funded research project.

Letters of intent can be e-mailed to

e.b.ward@larc.nasa.gov

or mailed to

Competition Administrator

AVSTO Mail Stop 254

NASA Langley Research Center

Hampton, VA 23681

For Student Internships

- 04/01/05 - Deadline for receipt of entry
- 04/16/05 - Announcement of awardees

For all other awards

- 05/01/05 - Deadline for receipt of entry
- 05/30/05 - Announcement of awardees

Eligibility

- Students who participate in NASA funded Exploration Air Vehicle research projects are not eligible to enter the competition. Faculty with such research grants are not eligible to advise or direct a team of students desiring to enter the competition. Examples of NASA

funded EAV research projects include any involving the Mars Flyer. Questions on eligibility related to this restriction will be handled on a case by case basis.

- This competition is open to individuals or teams from an accredited institution of higher education in the United States or its territories.
- Students must be enrolled in full-time, for-credit coursework.
- Students from non-US institutions can partner with a US institution if the partnership is initiated and overseen by faculty from both institutions.
- Students selected for internships must be US citizens.
- Each entry must have a written endorsement from a Supervising Faculty Member.
- A team may involve advisory and support personnel; however, those members are not eligible to receive internships or awards.
- Each team must designate a student team leader.

Criteria for Evaluation

Entries will be evaluated on how well they have focused their project and how well they have

addressed all aspects of the mission that they chose to examine. Each project will be judged on its own merit. In addition to following the prescribed format for submission, award level entries will be innovative and include a practical discussion of feasibility. All entries should include a baseline comparison with the relevant current technology, system, or design. All entries should include a brief review of current literature. Award level entries will be well written, thorough and concise.

Awards

The number and type of awards will be based on availability of funds. An award event, including student presentations of winning projects, will be held in conjunction with a major national aviation event, such as the Experimental Aircraft Association's AirVenture. It is not necessary to attend the event to receive the award.

Financial awards are restricted to US colleges or universities. Foreign colleges or universities can enter if they partner with a US college or university and the US institution assumes the lead. Financial awards will be made only to US institutions or US Citizens.

Past Award Winners

2004 First Tier

*Cornell University
Mechanical and Aerospace Engineering
Mars Flyer, Unmanned Air Vehicle*

*Georgia Institute of Technology
Aerospace Systems Design Lab*

High Altitude Long Endurance Vehicle UAV

*Virginia Tech and partner, Loughborough University
Aerospace and Ocean Engineering Department*

Centuria Personal Air Vehicle

2004 Second Tier

*Clemson University
Dept. of Mechanical Engineering*

Aerius, High Altitude Long Endurance Vehicle

*Montana State University
Department of Mechanical Engineering
Chimera, Unmanned Air Vehicle*

*Pennsylvania State University
College of Engineering
Personal Air Vehicle*

University of Virginia

*Mechanical and Aerospace Engineering Department
Nerius, Runway Independent Vehicle*

2004 Third Tier

*University of Kansas
Industrial Design*

Airport Design Study for Personal Air Vehicle

*Ohio University
Russ College of Engineering and Technology
Aeromobile, Personal Air Vehicle*

*Pennsylvania State University
College of Engineering
Hydrogen Fueled Commercial Transport*

2004 Honorable Mention

*Christopher Pigott
Iowa State University
Personal Air Vehicle*